

# **“RESEARCH EDUCATION”: A CONCEPT WIDER THAN POSTGRADUATE SUPERVISION?**

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## **Abstract**

This paper promotes the argument that although conventional postgraduate supervision is useful to address the research skills and competences of postgraduate students, a wider perspective is nonetheless required to educate and train any researcher (including postgraduate students upon their entrée into the world of research) to comprehend the demands made by research and how best these demands can be addressed. It is in this context that a more comprehensive concept of research education is promoted. The argument is based on the perspective that methodological understanding alone is not sufficient to assist a researcher in meeting the expectations of a research project. Research education refers to the training of researchers to be responsive to the research value chain. This includes aspects such as the formal research process, the importance of research ethics and integrity regarding the research project, the imperative to promote scholarship in research and the application of research results through technology transfer, innovation and incubation. Research education sensitizes the researcher to look beyond the scope of the academic research project and to extend the research to activities such as technology transfer, innovation, commercialization and partnerships. The aim of research education is to promote the wide range of aspects contributing to the understanding of what counts as research and its application.

**Keywords:** Research education, methodological training, assessment, postgraduate supervision.

## **1. BACKGROUND**

Marais and Marais-Pienaar (2010) drive the argument that research training of researchers and postgraduate students should include more than methodological research training alone. They are advocating that researchers should have a broader understanding of research and research-related practices in order to do research than has been the case with conventional postgraduate supervision. A supportive example is that one cannot successfully apply for funding if one does not have a solid research project (based on sound research methodology) and the know-how of how to apply the guidelines/expectations of a Funding Agency (which is also a broader issue than research methodological matters). Friedrich-Nel and Lategan (2009) embrace a similar perspective. In what they call “[a]ttending to the void in postgraduate supervision and assessment,” the aforementioned authors comment that there is a need for training on how to assess a thesis or

dissertation (referring here, of course, to formative/summative assessment). This need goes beyond the subject-specific knowledge that is required in thesis and dissertation assessment. It includes the way in which feedback should be communicated, arguments should be phrased and how scholarship should be developed. Tancing (2009) also agrees with the need for generic skills besides research skills. Among others, she refers to questions of curricula, methods and teacher-student interaction.

The argument is thus clear: Research training entails much more than merely matters of a methodological nature.

In this paper the focus will be on how extended values in the training of researchers and postgraduate students can be accommodated. In doing so, this paper will first investigate what research training textbooks advise on the topic of research training development.

## **2. A CONTENT ANALYSIS OF SELECTED RESEARCH TEXTBOOKS ON THE PRACTICE OF RESEARCH – LESSONS FOR TRAINING RESEARCHERS AND POSTGRADUATE STUDENTS**

A content analysis of a number of research textbooks shows that research is a process that needs to be informed by a research problem (Why am I doing the research?), evidence in support of how to solve the research problem (research design, methodology, literature review, data), conclusions (Have I solved the problem and what findings can be presented on the basis of my conclusions?), the application of research results (Technology Transfer), the possible intellectual property (Intellectual Property Rights from Publicly Financed Research and Development Act 51 of 2008; see RSA 2008) emanating from the study and, finally, the commercialization of the research (the financial value of the research). From doing the research, it should be clear that these stages are all interlinked and follow a typical rolling process. From these comments, the following observation can be made: Undertaking a research project presupposes a dynamic interaction between the various stages of the research project. Although evident, the various stages of a research project are very often ignored when novice researchers and postgraduate students are trained.

The latter comment - i.e. that the various stages of a research project are very often ignored when novice researchers and postgraduate students are trained - is supported by a number of research textbooks. Maree (2007), for example, refers to “First steps in research” in the title of a book he edited. A typical approach to research is pursued in this book, namely following particular steps in the research process: the research question, the planning of the proposal, qualitative research designs and data gathering techniques. According to this approach, the research project starts with the research problem which will then form the basis for the planning of the research project.

Once this approach is completed, the research design will follow where after information will be sampled in support of the stated research problem.

Although Potter (2002) proposes basically the same process as outlined in the above-mentioned book edited by Maree (2007), his emphasis is on the dynamism between the various stages of the research project. He argues that the research should be understood as a flow diagram. It includes a number of stages that feed into each other. Potter (2002:6) rightly observes that “[p]ostgraduate, and all academic research, may be better thought of as a flow diagram, around which you will go several times between key boxes until you exit at the bottom”. The assumption is that these stages should not only be visited frequently, but also be reviewed continuously. The conclusion here is that the various stages of the research project should not be seen in isolation from each other and that as one's knowledge grows, the better one is in a position to add more knowledge to a particular rubric in the research process. According to “Doing postgraduate research” (Potter 2002), the research project is not limited to the solving of the research problem. The book also refers to the important role of research ethics and integrity and the summative assessment of the project. These two additions to the research process are important for several reasons. Firstly, it indicates that research pedagogy cannot be limited to doing research only, but that comprehending assessment is also crucial in monitoring and evaluating the research. Secondly, value should be added to the research project through the application of sound ethical practices such as honesty, integrity, care, respect and responsibility. Thirdly, it sensitizes researchers that all research should be subjected to peer-review and that research cannot be practised in a value-free environment.

Blaxter, Hughes and Tight (2006) share the same holistic perspective as Potter, although they are more articulated in the way in which the research process should be seen. They acknowledge that some people see research as a fixed, linear series of stages. Alternative approaches can also be considered. One such an alternative approach is to see research as a circular process. This means that one can enter research at a number of points and that knowledge of later stages can lead to the reinterpretation or revisiting of earlier stages. Another process that can be identified, is the cyclical process. This is a process very much similar to action research. Instead of these processes, Blaxter *et al.* (2006) prefer to see the research process as a spiral process. The spiral process means that the kind of research and the research design will determine the research approach to be followed. What should be further appreciated in their research approach is that (i) the researcher should have a skilled understanding of the method(s) to be employed in the research project, (ii) the way in which the researcher should write scientifically is important in the successful completion of the research project, and (iii) that the research project should be managed to secure the successful completion thereof.

Anderson and Poole (2009) outline the significance that scientific writing has for thesis, dissertation, journal, conference paper and newspaper writing. In formal writing there is a particular structure evident. They suggest two different approaches to empirical/ experimental and analytical/literary writing. The former will capture content such as Problem – Design – Procedure – Analysis – Conclusions whereas the latter will include the following content: Objectives – Procedures – Analysis – Conclusions.

From the analyses of the various textbooks referred to above, it is evident that there are common points of agreement on educating researchers and postgraduate students on doing research, namely that it demands (i) an understanding of what research is, (ii) comprehension of the research process, (iii) having insight into those contextual factors influencing research, and (iv) compiling a framework within which research can be conducted.

The above-mentioned needs give witness to the statement that training researchers only on the “academic” aspects of the research process is to negate the comprehensive needs associated with research training. This statement will be elaborated on and more closely defined in section 3 below.

### **3. LESSONS LEARNT FROM POSTGRADUATE SUPERVISION PRACTICES IN SUPPORT OF RESEARCH EDUCATION**

Up to now this paper focused on two perspectives: (i) that postgraduate supervision is too limited in its focus to address the requirements of the research value chain (hence the argument that research education can address this shortcoming), and (ii) it is not only postgraduate students who need to be trained with a view on how to be responsive to the research value chain, but all researchers. Research education is therefore presented as an extension of postgraduate supervision in so far as it is a concept that goes beyond the training of postgraduate students. It can be used in the training of researchers whose training needs go beyond the education for the sake of obtaining a qualification. In this section the lessons learnt from postgraduate supervision practices will assist with conceptualising research education.

#### **3.1 The complexity of postgraduate supervision**

Postgraduate supervision entails much more than simply “telling” a student how to do and/or improve a research project. This is evident from the following definition of postgraduate supervision suggested by Lategan (2008:4):

“Postgraduate supervision is defined as the active engagement of a supervisor in assisting the postgraduate student in identifying a line of inquiry, delineating the scope of the project within the line of inquiry, and providing guidance to lead to the successful completion of the project and the dissemination of results.”

Associated with postgraduate research are challenges such as subject-specific knowledge, policy issues, funding, different forms of assessment, the science of postgraduate assessment, science (scientific / academic) writing and publication, ethics and integrity, intellectual rights and authorship during publication.

Trafford and Leshem (2008) complicate matters by referring to what they term “doctorateness.” Doctorateness refers to the uniqueness of the doctoral study compared to any other given study. One can add to this debate by asking: “Where is the ‘D’ in the PhD?” (Lategan, 2013) This question refers to the distinctiveness of doctoral studies, the integration of high-level research skills in the thesis and how the research study is being communicated to the public domain. It is therefore evident that postgraduate supervision is an important but very often neglected skill and activity in the research process. De Gruchy and Holness (2007:109) refer to four important directives for postgraduate supervision:

- In postgraduate supervision the research project is overseen.
- In postgraduate supervision the craft of research should be taught.
- The supervisor should be a research role model.
- The supervisor is characterized by a supportive relationship.

It is also evident that postgraduate supervision is of interest to more than one party (Lategan, 2009c):

- University administrators have taken an interest in postgraduate supervision due to the prestige associated with postgraduate studies (for ranking purposes), the monetary value (subsidy) linked to the awarding of postgraduate degrees and the building of a research culture at universities (research is one of the university's core functions).
- Policy makers' interest is driven from a steering perspective: How are universities meeting the targets and profile set for the transformation of this aspect of the university curriculum?
- Supervisors are interested due to new research challenges associated with their scientific fields of study. Invention of new knowledge is not negotiable. Completed supervised studies are also a criterion for promotion.
- Researchers on the issue of postgraduate supervision are enquiring into aspects such as epistemological development, conceptual formulations, knowledge invention and ontological progress. New bodies of knowledge can thus be developed via research projects.

The communality between all these parties' interest is that supervision is an essential aspect in developing a sustainable research culture. Supervision does not only link directly with research, but also with teaching (as another core activity of a university). Tancing (2009) observes that doctoral study is lately seen as "a programme of study, in which students learn a wide variety of generic skills [...] that may be useful in their future employment frameworks."

Apart from these interests, some expectations are also contributing towards the challenges of postgraduate supervision. These expectations are raised by supervisors and students alike. Bitzer (2009) remarks that past concerns have mainly focused on throughput and attrition. It resulted in attending to efforts how soon students can complete their studies. Very little attention has therefore been paid to the supervisory process. This creates tension regarding how the postgraduate supervision relationship is managed.

Common roles and responsibilities of the supervisor and student relate to the following expectations (see Lategan, 2009b):<sup>1</sup>

- The need for a good relationship between the supervisor and student.
- Different supervision styles should be acknowledged and agreed on.
- Professional behaviour is expected from both supervisor and students.
- Commitment is fundamental for the successful completion of the project.
- It is necessary to realize that anxiety can occur in doing and/or assessing the project and to take note of that anxiety.
- The execution of the research projects may not be an easy process.
- Postgraduate training is not always focusing on the stimulation of scholarly behaviour.
- Students need role models to whose example they can live up to.
- Not enough attention is paid to ethical questions and the integrity of the project and/or the supervisory practices.

On the basis of the above-mentioned observations, one can draw the following conclusions for the central argument of this paper, namely that both researchers and postgraduate students should be subjected to research education:

- Supervisors need to be trained to successfully carry out postgraduate supervision (to promote scholarship and to know how to engage with one-on-one teaching).
- Postgraduate students need to have knowledge of the research process and subject-specific knowledge regarding their field of study.

<sup>1</sup>This project is based on postgraduate students' drawings of their supervisors. Based on a psychological analysis of meaning (for example the size of hands and feet, length of arms, facial expressions, etc.) one can deduct that there are mutual expectations which are not excluding the different parties (supervisor and student) from these common expectations (see Lategan, 2009b).

### 3.2 What prevents postgraduate students from making progress?

Research has indicated that factors such as a lack of money, facilities, family responsibilities, support for research projects, poor supervision, difficulties in mastering the research process, limited feedback and support contribute towards the delay in or the non-completion of studies. This observation is confirmed by various resources (cf. ASSAf, 2010; Schulze, 2011; SARUA, 2012). A case study undertaken by Lategan (2009a) reports on postgraduate student training and some environmental factors impacting on students' progress:

- Postgraduate students tend to take longer than the normal residency period for studies. This is based on the multiple registration years. A national study by Mouton (2010) has confirmed that enrolment and completion of a doctoral study takes on average 4.8 years. Although this period goes beyond the official residency period, it is still in line with international trends.
- Supervisors moving to other universities also challenge the continuation of supervisory support and the sustainability of the project. Although a memorandum of agreement is signed between the supervisor and the student, it is a well-known fact that this relationship is very often challenged through a lack of commitment on both parties' side.
- Although ample funding support for students exists, the problem is that students are not always making use of these external funding opportunities (such as, for example, Agricultural Research Council, Medical Research Council, National Research Foundation and Water Research Commission). It is very difficult to understand why students are not more eager to apply for funding despite the ample funding that is available.
- The protocol takes far too long before it is submitted for final approval. This can be due to two reasons. Firstly, the protocol is regarded as the penultimate version of the study instead of merely a project plan on how the research will be executed. Secondly, the protocol phase, being the planning phase of research, is not separated from the execution phase of the research project. These reasons exist over and above the untested observation that the protocol is also an expression of a student's commitment towards his or her studies.

The above-mentioned findings lead to the conclusion that the supervisory process demands a more comprehensive procedure than methodological matters only. It should be obvious that supervisors and their students should engage with a training programme that straddles all aspects of the research process.

These aspects supersede the normal process associated with doing research. It is in this context that one can conclude that research education can assist both the supervisor and postgraduate student to have a broader comprehension of the research value chain.

#### **4. IN SEARCH OF CRITICAL THINKING AND SCHOLARLY PRACTICE**

Two important activities in the research value chain are the way in which critical thinking underpins the findings of the research project and how scholarship is central to the research process. In this section of the paper arguments will be presented in support of science (scientific/academic) communication as basis for critical thinking and ontology as part of scholarly activities.

##### **4.1 Science (scientific/academic) communication**

It is always troublesome to interact with academics who obstinately and inflexibly cling to “fixed” concepts, assumptions, and perspectives without realizing that, generally, science itself is continuously in a state of renewal. The issue is not with working from a specific paradigm but that a researcher may not be willing to ask if an alternative approach should not be considered. It is equally challenging to debate anything with academics who have no appreciation for the prolegomena of their science. One tends to ask what the rules of the scientific debate are? In view of this question, Strauss (2009) provides some useful comments through his ground rules for academic communication. According to him, one needs to know your own scientific framework, identify those of the other person and debate/critique a topic on the basis of similarities and differences. The value of Strauss' perspective is that one needs to understand a science in its complete domain of development. This means that there is no point in critiquing a framework/perspective if one does not understand what constitutes such a framework/perspective. The quest for critical thinking is therefore fundamental to scholarship.

Rossouw (2005) is as helpful as Strauss with his guidance on the intellectual skills required in science. Although Rossouw frames his guidance against the background of the social sciences, he rightfully remarks that one must be fully aware of one's own prejudices and shortcomings. He furthermore emphasizes that the practise of science should take place amongst peers. He outlines the following intellectual tools for research:

- The willingness to listen to, investigate and understand new ideas (tolerance).
- Intellectual fairness will avoid irrelevant hair-splitting or unnecessary criticism.



- Honesty concerning one's own prejudices, preferences and sentiments.
- Willingness to analyse with a view on understanding what the debate/topic is all about.
- The willingness to fit questions and arguments into the greater context.
- Willingness to experiment. Can things be different? Is there an alternative?
- Intellectual perseverance. It takes time to work through an argument and to form an independent perspective.

These comments by Rossouw suggest a particular way of doing research. Firstly, should the research topic reflect a core issue within a field of study. Secondly should new epistemological and ontological questions be asked. Thirdly is the objective for doing research not to extend what is already known, but to search for new analysis, interpretation and meaning. Such an approach calls for curiosity in doing research.

A fascinating encounter on curiosity in science is reflected by Schwartz (2008) in his essay "The importance of stupidity in scientific research." In this essay Schwartz claims that what is ultimately needed in research is a position where people claim that they do not "know" and hence they would like to understand a phenomenon. He further states that acknowledging one's limited knowledge and understanding of what a topic is all about, is essential for research. Schwartz (2008:1771) comments:

"What makes it difficult is that research is immersion in the unknown. We just don't know what we're doing. We can't be sure whether we're asking the right question or doing the right experiment until we get the answer or the result."

This confirms a fundamental value that paradigmatic orientation does not exclude a broad-based understanding (at least the historical developments) of a science.

## 4.2 The problem of ontology

McKenna (2011) advocates that supervisors and researchers should be more mindful of ontology in research – by understanding what ontology in research means and how to critically reflect on it. She equates the impact of denying the role of ontology in research with telling a lie. The absence of critical reflections on ontology can very easily lead to (unconscious) manipulation of research results, adopting a one-sided approach to a research problem and not adequately exploring what other possibilities exist. The way in which one constructs a research problem, presents arguments, selects methods and focuses on literature can (easily) lead to an anticipated outcome.

McKenna (2011) outlines four types of “lies” that supervisors and students should be mindful of. There is, firstly, the “lie of omission” – precisely what is it that one is looking for in the research? (the “truth” value). Does one sufficiently identify the possible range of questions that could be asked and is one able to track the validity of the arguments? It cannot be categorically accepted that a science community works with a flat ontology. Secondly there is the “unintended lie”. This concept refers to the situation where one is able to discover/uncover/see only that which one's training allows one to discover/uncover/see. Thirdly there is the “fraudulent lie.” This type of “lie” relates to the role of subjectivity in research. One should be mindful that knowledge is never a formulation of one's own rigor. Fourthly and finally there is the “postmodern lie” which abandons “universal truths and ground theories”. Not everything in reality can be under suspicion as if it does not exist or needs to find a new meaning every time it is used or encountered.

A remark by Jansen (2007) can be linked to the awareness outlined above. He comments that research has its own language and grammar which should also be mastered. He refers to structuralism, postmodernism, critical theory and rationalism and raises the importance of understanding how the relevant ontologies of these influence the researchers' viewpoint.

Research is therefore not limited to an own understanding or interest in the research project, but warrants an in-depth understanding of which ontology forms the basis of a scientific search.

## **5. THE RESEARCH PROCESS – COMPLEX BUT STRUCTURED**

Based on the context of research education (cf. par. 2 above), the common challenges facing postgraduate supervision (cf. par. 3 and par. 4) and the general need for both researchers and postgraduate students to have a broader overview of the research value chain, the following attributes can be made towards a holistic understanding of the research process in the context of the research value chain.

The research problem seems to be the focus point of a research project. The research problem will be addressed by an appropriate method to produce solutions to the research problem. A fundamental link between the research problem, method and solutions are (i) the project design, (ii) the evidence produced on how the problem was addressed, and (iii) the findings/conclusions based on the evidence produced. One can, for further debates, refer to it as the PDMEFC [P(robblem) – D(esign) – M(ethod) – E(vidence) – F(inding) – C(onclusions)] approach. Yet, this approach remains incomplete if Analysis (distinction on the basis of similarities and differences) is removed from the process flow. Analysis will deal with understanding the research problem in a scholarly context – how does this question fit into the broader prolegomena of the scientific discipline? The answer to this question will assist with the overall design of the project.

Two additional processes are overarching the research project: research ethics and integrity and scholarship. Research ethics and integrity will deal with the question whether universally accepted values are evident in the research project and if the science community and public have confidence as regards how the research was carried out, how the resources were utilized in the research process, how the results were communicated to the scientific and public community, and what benefits the research results will bring to society. Research ethics will reflect on items such as the integrity of the data, the text and the engagement with the research sample. Scholarship refers to the creative and intellectual approach to the research project. These approaches will lead to the development/creation of new knowledge.

The above-mentioned approach is not completed unless it is subjected to self-assessment. The importance of self-assessment is to provide the researcher with the opportunity to engage with his or her findings first before it is submitted for (formative or summative) assessment as quality assurance mechanism. Typical self-assessment questions could include:

- Why am I undertaking this project?
- What is my research problem all about?
- How novel is my project?
- What makes this project a “must”?
- How do I use the literature to support my research?
- What is my research method and what does the research methodology entail?
- What is the purpose of the protocol?
- How do I assess my own research?
- How do I view supervision and mentorship?
- What is the role of postgraduate assessment?
- How do I write up my research?
- How do I take my research to publication and presentation?
- Who will be interested to fund my project?
- Is my project affordable?
- Are the resources needed/required for my project available?
- It is a researchable topic?
- What is it that I intend doing?
- How well am I prepared for doing my research project?

On the basis of these observations, a basis for research education will be presented.

## **6. RESEARCH EDUCATION – A CONCEPT FIT TO MEET THE CHALLENGES ASSOCIATED WITH RESEARCH TRAINING?**

In this paragraph the well-known concept of postgraduate supervision will be extended to what the author would like to refer to as research education.

Postgraduate supervision is normally understood as the education (encompassing such things as information, guidance and support) a master's or doctoral student requires when the project for master's or doctoral studies is pursued. It deals with research capabilities at either the master's or doctoral level. Postgraduate supervision is therefore very often limited to enabling the master's or doctoral candidate to complete his or her research dissertation/thesis. Postgraduate supervision revolves around discipline knowledge, methodology, research design and pedagogy. As pedagogy, postgraduate supervision is about teaching, learning and knowledge generation directed at the master's or doctoral dissertation or thesis. Postgraduate supervision prepares students to participate in the research projects associated with their disciplines. A common characteristic of postgraduate supervision is that it reflects more research activities than methodology alone. Standard topics include issues relating to the research process, the execution of the research and the finalization of the research project. Typical themes are on the research protocol (plan), the supervisory process, the writing up of research and technical issues such as referencing, technical requirements of the study and so forth (see for example Mouton [1996; 2001]; Potter [ed.] [2002]; Maree [ed.] [2007]; Trafford & Leshem [2008]; De Vos, Strydom, Fouché & Delport [eds] [2005]).

This paper proposes research education as an extension of postgraduate supervision. Research education can be broadly defined as what knowledge and skills are required to engage with all the stages of the research process in the research value chain. Research education is therefore broader in scope than postgraduate supervision. It is a pedagogy directed at comprehending the various stages of research, ranging from problem identification to problem solution, from problem solution to incubation, product development to innovation, from innovation to commercialization to production, from production to the end-user (which refers to various communities – business, industry, government, social communities and the like) (see Lategan, Lues & Friedrich-Nel [eds] [2011]; Lategan & Holzbaur [eds] [2009] and Holzbaur, Lategan, Dayson & Kokt [2012]). Research education can therefore be labelled as a field of study in its own right.

Research education is an emerging concept that is especially applicable to the development of researchers and their skills. This is evident based on a growing discussion during the last decade on how to guide the novice, mid-career and established researcher in doing research, supervising research, assessing research, publishing research and participating in research activities such as scientific editing, conference presentations, editorial work, funding applications, incubation, technology transfer and commercialization. In addition, although on a different conceptual level, issues such as scholarship, quality assurance, assessment and objectivity and subjectivity in the research process, are core to the successful completion of a research project.

Although the agenda for research education could be outlined, it would be inaccurate to claim that all knowledge associated with and exposed as research education in this paper is complete. It is clear that on some issues there is still a lack of information and discussion on a theme that will guarantee that the novice researcher is well prepared for the research assignment. A relatively new addition to this pedagogy includes research ethics and integrity, mentorship and project planning. A serious shortcoming is the debate on technology transfer and commercialization of research as well as intellectual property, plagiarism and co-authorship. Needless to say, it would be a fallacy to report that information on these and many other topics are not available. The truth is, however, that the debate on new emerging themes such as research training for staff and students, research and innovation, ethics and integrity and the enterprise are not yet widely debated in the context of pedagogy as one would have hoped for. In addition, one should add that (post)graduate students are not informed well enough on these matters. The reason for this is simply that in the training at postgraduate level, the emphasis is primarily on the scientific project and very little formal attention is paid to research education. (Cf. par. 2 for an overview of topics covered by research textbooks.)

A basis or research education needs to be developed to address this claim. The reasons for drafting such a basis are based on five observations:

*Firstly*, students have difficulty to understand the research process holistically. The separate activities are often not well integrated into a meaningful whole. This relates to a structural understanding of the research process. Research education can assist with understanding how the various research aspects relate to each other.

*Secondly*, since not all activities during the research process are reported on extensively, it can create the misperception that some activities are conceptually more important than others.

*Thirdly*, the absence of scholarly work is a concern. Assessing research projects often leads to the conclusion that no new meaning and knowledge are added. This links to the common perception that universities train postgraduate researchers, they do not educate scholars.

*Fourthly*, the absence of the student voice in the text, questions whether the student has really mastered the study. Students are not always good at formulating an own perspective when they engage with the literature review. In fact, one gets the impression that students do not (adequately) reflect on the literature. Quoting from the literature is not the same as engaging with the literature.

*Fifthly*, the research process is associated with a continuum of activities starting with the research problem and ending with the patenting and commercialization of the solution to the research process. This approach presupposes that all solutions have patenting and commercial value. The merit thereof is nonetheless debatable. What is important, however, is the realization that the research is not necessarily completed when the research problem has been addressed (commonly referred to as the completion of the research cycle). Patenting and commercialization, in other words, can still follow.

These comments call on the (future) development of research education. The justification for a research education framework is based on three theorems:

- Postgraduate education is part of the teaching/learning portfolio which is directed at the skills and knowledge development of students.
- Research education is transdisciplinary in nature and supports policy directives for postgraduate students.
- Researcher training includes much more than underpinning academic skills; it should also include the aspects of the innovation value chain.

## **7. CONCLUSION**

From the research in this paper it is evident that (i) sufficient grounds exist to promote research education as an extension of conventional postgraduate supervision practices; (ii) it is also evident that such a concept will cover a broad range of activities associated with the research value chain that can be regarded as directive in taking a research project beyond its typical scope of solving a problem only and (iii) this study also outlined the fact that no research training can be limited to methodological matters only, but that a number of research activities associated with the research value chain should be incorporated in the training of researchers and postgraduate students.

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